0048

TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

August 7, 2008

TO: Internal File

THRU: James D. Smith, Permit Supervisor

FROM: Steve Christensen, Environmental Scientist II

RE: Full Extraction Pillar Splitting- Life of Mine, Consol Coal Company, Emery Deep, C/015/0015, Task ID #2990

SUMMARY:

On June 13th, 2008, Consolidation Coal Company (the Permittee) submitted an amendment to the MRP that details the Emery Deep Mine's full extraction pillar splitting plan for the life of mine. The amendment was submitted based upon a conditional approval granted by the Division of Oil, Gas and Mining (the Division) for full extraction mining of the Zero North, 15th West, 4th East and 6th East on November 30th, 2007. The conditional approval was outlined in a November 30th, 2007 letter to the Permittee. Four conditions were listed in the November 30th, 2007 letter. Condition number 2 called for the Permittee to submit a "comprehensive 5-year mining plan".

The Permittee intends to increase their recovery of the coal by utilizing a pillar splitting plan that would fall into the planned subsidence category. The full extraction plan is to be implemented on the remaining reserves within the approved permit boundary.

As part of a previous conditional approval (See Task ID# 2951), the Permittee updated the entire hydrology section of the approved MRP. The update to the hydrology information was part of a conditional approval for full extraction mining on the 14th west panel. The updated hydrology information and analysis was performed on the permit area (as currently approved in the MRP). The analysis took into account full extraction of the remaining coal reserves within the permit area.

The following memo examines the amendment relative to the hydrologic regulations of the State of Utah R-645 Coal Mining Rules. For purposes of review, Task ID #2990 was assigned for tracking purposes.

Finding:

The amendment meets the hydrology requirements as provided for in the State of Utah R645-Coal Mining Rules and should be approved at this time.

TECHNICAL ANALYSIS:

ENVIRONMENTAL RESOURCE INFORMATION

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR 783., et. al.

GENERAL

Regulatory Reference: 30 CFR 783.12; R645-301-411, -301-521, -301-721.

Analysis:

The application meets the requirements for General Environmental Resource Information requirements as provided for in R645-301-721. Beginning on page VI-1 of the MRP, the Permittee provides a brief discussion of the location and extent of subsurface water. The discussion identifies the Ferron Sandstone Member of the Mancos Shale as the only continuous aquifer beneath the permit and adjacent areas. Subsequent sections provide references within the application that provide additional information on: the location of surface water bodies, locations of monitoring stations, location and depth of water wells as well as surface topographic features. Water right information is provided in Appendix VI-4 and Table VI-1. Seasonal variations in groundwater levels are discussed in Section VI.2.4.1. Plate VI-3 provides the locations of surface water bodies both within and adjacent to the permit area. Water supply wells and ground water monitoring wells are shown on Plate VI-4. The depths of the wells (as well as other completion details of the wells) are provided in Table VI-2.

Findings:

The application meets the General Environmental Resource Information requirements as provided for in R645-301-721.

CLIMATOLOGICAL RESOURCE INFORMATION

Regulatory Reference: 30 CFR 783.18; R645-301-724.

Analysis:

The application meets the requirements for Climatological Resource Information as provided for in R645-301-724. Climatological information is presented in Chapter X, Part B of the approved MRP. The Permittee provides average seasonal precipitation as well as seasonal temperature ranges.

Findings:

The application meets the Climatological Resource Information requirements as provided for in R645-301-724.400.

ALLUVIAL VALLEY FLOORS

Regulatory Reference: 30 CFR 785.19; 30 CFR 822; R645-302-320.

Analysis:

Alluvial Valley Floor Determination

The application meets the Alluvial Valley Floor Determination requirements as provided for in R645-302-320. Chapter XI, *Alluvial Valley Floors*, of the approved MRP contains information regarding alluvial valley floors (AVF's) within and adjacent to the permit area. Plate V-5, "Subsidence Monitoring Points and Buffer Zones" depicts the locations of the alluvial valley buffer zones established by the Permittee. The buffer zones are located in the west central portion of the permit area adjacent to Quitchupah Creek in T22S R6 E in Sections 19, 29 and 30. Plate XI-1 in Chapter XI of the MRP depicts the areas identified as alluvial valley floors along the Upper Quitchupah Creek. Plate XI-1 also depicts the areas that have been grandfathered and not regulated as AVF's as outlined by the State of Utah R-645 Coal Mining Rules.

Chapter XI provides the geomorphic and geologic information utilized in determining the presence of AVF's within and adjacent to the permit area. A positive finding for an AVF was made in the upper sections of Quitchupah Creek within the permit area. Though flood irrigation is prevalent in this area of the permit, most of the floodwater is obtained from Muddy Creek approximately 20 miles to the northwest. In the areas where AVF's have been identified, the Permittee has established AVF buffer zones (as described above) where subsidence will not occur.

Findings:

The application meets the Alluvial Valley Floor Determination requirements as provided for in R645-302-320.

HYDROLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-724.

Analysis:

Sampling and Analysis

The application meets the Sampling and Analysis requirements as provided for in R645-301-724. On page VI-2 of the application, the Permittee indicates that the water samples collected and analyzed under the current MRP have been obtained either by utilizing the "Standard Methods for the Examination of Water and Wastewater" or 40 CFR Parts 136 and 434.

Baseline Information

The application meets the requirements for Baseline Information as required by R645-301-724. Beginning on page VI-3, the Permittee provides baseline information for ground and surface water resources.

Groundwater

Section VI.2.4.1 of the application presents a discussion of baseline groundwater conditions in the permit and adjacent areas. Groundwater quality and quantity are discussed for each of the three major stratigraphic layers of the Emery Deep Mine area: Quaternary Deposits (Qal), Blue Gate Member of the Mancos Shale (Kmb) and the Ferron Sandstone Member of the Mancos Shale (Kmf). Plate VI-5, General Geology, depicts the surface geology of the permit and adjacent areas.

Quaternary Deposits (Qal):

Beginning on page VI-3, the application discusses groundwater conditions in the Quaternary Deposits located primarily on the surface of the mine site. Table VI-3 provides field measurements from spring and seep inventories conducted in 1979 and 1980. The table provides minimum, maximum and average values for pH, temperature, dissolved oxygen, specific conductance and flow. During the spring and seep inventories, 16 seepage points were identified by the Permittee. Of those 16 seepage points, 14 of them were observed to be issuing from the pediment gravels overlying the Blue Gate Shale. These seepage points are primarily recharged by irrigation water from the overlying surface. The specific conductance values were much higher than would be expected from a natural groundwater source. Couple this observation with the fact that the springs and seeps were observed discharging from the pediment gravels adjacent to irrigated fields, it's likely that these seepage points wouldn't exist if not for the adjacent flood irrigation practices. Groundwater discharges from these Quaternary alluvial deposits exhibit higher flows during the spring and summer months when flood irrigation activities occur. The recharge to these springs is predominantly from Muddy Creek, which is located approximately 20-23 miles from the permit area.

Ten monitoring wells were completed in Quaternary deposits in 1982. Water level measurements collected from these wells are summarized in Figure VI-2 and presented in their entirety in Appendix VI-10. No consistent seasonal or long-term variations in water levels are evident in the alluvial monitoring wells. A summary of the water quality data collected from the Quaternary monitoring wells is provided in Table VI-4 with individual samples presented in Appendix VI-1.

Blue Gate Member of the Mancos Shale (Kmb):

On page VI-5, the application discusses the groundwater conditions encountered within the Blue Gate Member of the Mancos Shale. The Permittee and the USGS have installed several water-monitoring wells within this stratigraphic zone. Water level data collected from the Blue Gate monitoring wells is provided in Appendix VI-10 and summarized in Figure VI-4. Upon review of Figure VI-4, it appears that there is no consistent seasonal variation in water levels occurring in this geologic unit. However long-term water-level declines are apparent in the Blue Gate at monitoring wells I, R2 and AA. A comparison of Figure VI-4 with information presented on Plate VI-6, Historic and Planned Mining Sequence, would indicate that the timing of the water-level declines does not appear to be related to mining.

Historically, water quality data have been collected from only one monitoring well completed in the Blue Gate Member (Well T1-BG). Table VI-5 and Appendix VI-1 present the data obtained from this monitoring well. The data indicates that the water in the Blue Gate Member has a near neutral pH with a high salinity (TDS concentrations in the general range of 15,000 to 24,000 mg/L). The predominant ions within the Blue Gate groundwater are sodium and sulfate, which is indicative of the gypsiferous nature of the formation.

Ferron Sandstone Member of the Mancos Shale (Kmf):

The application provides a discussion of the groundwater conditions within the Ferron Sandstone beginning on page VI-5. The Permittee provides a discussion as to the calculated physical characteristics of the aquifer (transmissivity and storage coefficients) and provides the sources of those values. Groundwater within the Emery Mine permit and adjacent areas occurs primarily in the Ferron Sandstone Member of the Mancos Shale. The Ferron Sandstone Member contains the coal that is extracted from the Emery Mine. It is bounded by the Blue Gate Member above and by the Tununk Member of the Mancos Shale below.

According to Lines, G.C. and D.J. Morrissey. 1983. Hydrology of the Ferron Sandstone Aquifer and Effects of Proposed Surface-Coal Mining in Castle Valley, Utah. U.S. Geological Survey Water-Supply Paper 2195. Alexandria, Virginia the source of groundwater recharge for the Ferron Sandstone within the permit and adjacent areas is the Joe's Valley-Paradise fault zone. The water originates as precipitation at higher elevations along the Wasatch Plateau to the west. Lines and Morrissey (1983) estimated that recharge to the Ferron Sandstone aquifer is approximately 2.4 cfs along the Joe's Valley-Paradise fault zone east of the Emery Mine. Due to the relatively impermeable nature of the Blue Gate and Tununk Members of the Mancos Shale and the limited precipitation that falls on the valley floor, direct recharge to the Ferron Sandstone from precipitation and from overlying and underlying formations is considered minimal.

Plates VI-1 and VI-2 depict the potentiometric surface of the upper and lower Ferron Sandstone for 1979 and 1985 respectively. These maps indicate that groundwater within the Ferron aquifer moves generally up dip and in a southeast direction through the permit area.

Plates VI-7 and VI-8 depict the potentiometric surface of the upper and lower Ferron Sandstone, respectively, for 2006. Upon review of Plate VI-7, the Upper Ferron Sandstone potentiometric surface is clearly influenced by the effects of discharging water encountered during mining operations.

Figures VI-5 and VI-7 provide hydrographs of water-level data collected from the Upper, Middle and Lower Ferron Sandstone from roughly 1976 to the present. Upon review of the hydrographs, it's clear that all three layers of the Ferron Sandstone have experienced declines as a result of mining activity. The Lower Ferron Sandstone unit depicts the most stable and relatively constant water levels over the period of record. The impacts due to mining activity appear to be more pronounced in the Middle and Upper Ferron Sandstone, which would be expected given the location of the coal seam. Upon comparing Plate VI-6, Historic and Planned Mining Sequence, with the hydrographs, it appears that the timing of water level declines in many of the monitoring wells (depicted in Figures VI-5 and VI-7) correlates well with mining activity (as depicted on Plate VI-6).

The Permittee provides a summary of water quality analyses for groundwater samples collected from the Ferron Sandstone in the permit and adjacent areas in Table VI-8, Groundwater Quality Summary- Ferron Sandstone Wells. The table provides minimum, maximum and mean water quality values for both the Upper and Lower Ferron Sandstone. AppendixVI-1 provides the results from individual groundwater samples collected both within and adjacent to the permit area.

The groundwater quality of the Ferron Sandstone is discussed on page VI-9. The pH of the Ferron Sandstone tends to be moderately alkaline, averaging 7.9 in the Upper Ferron and 8.2 in the Lower Ferron. The TDS concentration of water in the Upper Ferron Sandstone is significantly lower than the overlying Quaternary deposits and Blue Gate Member of the Mancos Shale, averaging approximately 1,600 mg/l in the Upper Ferron and 690 mg/l in the Lower Ferron.

Groundwater chemistry analyses suggest that the Upper Ferron Sandstone tends to be a sodium sulfate type, while the Lower Ferron Sandstone is a sodium sulfate/bicarbonate type. Taking into account differences in TDS concentrations and the general chemistry of the two geologic units, it would appear that there is at least some hydraulic separation between the Upper and Lower Ferron Sandstone.

Surface Water

Beginning on page VI-10, the Permittee provides a discussion as to the surface water conditions located within and adjacent to the permit area. The Emery Deep Mine's surface facilities are located at the confluence of Quitchupah Creek and Christiansen Wash. Christiansen Wash is a tributary of Quitchupah Creek. Quitchupah Creek is a tributary to Ivie Creek, which in turn, is a tributary to Muddy Creek. Muddy Creek discharges into the Dirty Devil River, which flows in to the upper Colorado River.

The Permittee identifies Quitchupah Creek as a perennial stream whose headwaters in the eastern flank of the Wasatch Plateau are primarily sustained by snowmelt. Both Quitchupah Creek and Christiansen Wash receive additional flow in the vicinity of the mine from several sources unrelated to the Emery Mine, which include:

- Irrigation return flow whose source is primarily Muddy Creek;
- Irrigation induced seepage from Quaternary pediment deposits;
- Groundwater discharging from the Ferron Sandstone;
- Water discharged from the Emery Mine; and
- Localized overland flow from storm events.

Plate VI-9, *Miscellaneous Surface Water Data Collection Sites*, depicts surface water monitoring locations from the permit and adjacent areas. Appendix VI-5 provides surface water monitoring data including both flow and water quality information. Appendix VI-11 provides the USGS stream flow data collected from a stream gauging station on Quitchupah Creek, immediately above its confluence with Christiansen Wash (Site S-24 on Plate VI-9). Average monthly flow at this location during the period of record varied from 2.6 cubic feet per second (cfs) in August and October to 17 cfs in May. Approximately half of this flow occurred in the months of March through June, presumably as a result of snowmelt runoff. A substantial amount of flow also occurred, on average, in September. The higher flow volumes in September were presumably from thunderstorm/rainfall events. The USGS also maintained a stream gauging station on Christiansen Wash, immediately above its confluence with Quitchupah Creek (Site S-

14 on Plate VI-9), from August 1978 through September 1984 (See Appendix VI-3). Average monthly flow at this location during the period of record varied from 1.2 cfs in December to 6.9 cfs in June and July. The highest flow volumes occurred in the period of April through September, presumably as a result of snowmelt runoff and rainfall events.

Daily streamflow data collected by the USGS from Quitchupah Creek and Christiansen Wash are presented in Figure VI-11. Upon review of the figure, it's clear that both streams experience a wide seasonal fluctuation as well as occasional flood events. Fluctuation in streamflow is evident during the spring and summer months. In the spring it's likely that the fluctuations are produced by temperature gradients as it affects the melting of mountain snow pack. In the summer and fall months, flow fluctuations are likely a result of rainfall events as well as anthropogenic irrigation return flows.

The Permittee provides a summary of streamflow data for Ivie Creek and Muddy Creek for various periods of record in Figure VI-12. A summary of the data is provided in Appendix VI-11. Annual flow data collected by the USGS from these locations, as well as the Quitchupah Creek and Christiansen Wash stations are summarized in Figure VI-13. As with trends exhibited in the previously mentioned data, streamflow varies widely in the region on an annual basis. The variations in flow appear to be less extreme in Quitchupah Creek than in the surrounding streams, given the consistent discharge of mine water to Quitchupah Creek.

Muddy Creek serves as the primary source for irrigation water in the permit and adjacent areas. Muddy Creek flow is diverted from approximately 20 miles northwest of the permit area. Additional points of diversion are located about 6 miles north and 4 miles northeast of the permit area.

Table VI-10 provides USGS data compiled during a seepage study along Quitchupah Creek and Christiansen Wash. The data indicated a general downstream increase in flow on both streams.

Due to the variety of both natural and anthropogenic influences on streamflow in the permit and adjacent areas, it's difficult to determine the individual contributions to streamflow from irrigation return flows, seepage natural discharge from the Ferron Sandstone, overland flow and losses to seepage into the overlying alluvium. The only discharges and contributions to the system are a result of measuring the discharges from the mine (See Figure VI-9).

The Emery Mine has eight discharge points that are regulated under permit number UT 0022616. Table VI-11 lists the outfalls and corresponding pond number (as identified in the MRP) as well as the corresponding surface water-monitoring site. Average flow rates associated with these discharge points are presented in Figure VI-9. Consistent discharges have only occurred at UPDES points 001 and 003, where water is pumped from the underground mine workings. Eight discharge events have occurred since 1991 at UPDES point 004. The discharge at this point also represents mine water, which is used by a local farmer for irrigation practices. Since 1994, discharge has occurred at UPDES point 007 on two occasions. No discharges have occurred from any of the other UPDES points since monitoring began.

Surface water quality has been collected from several locations within the permit and adjacent areas (See Plates VI-4 and VI-9). The U.S. Geological Survey (USGS) conducted a water-quality study on Quitchupah Creek from July 1975 through September 1976. Samples were collected at site S-18 where State Highway 10 crosses Quitchupah Creek and at site S-29 on Quitchupah Creek where it joins Ivie Creek (See Plate VI-9). The Permittee provides the water-quality data/analyses summaries for these sites in Appendix VI-13. The data indicates an increase in concentrations between these two sampling sites, with pH increasing slightly from an average of 8.1 to an average of 8.3; TDS increasing from an average of 939 to an average of 2,406 mg/l, and the sodium adsorption ration (SAR) increasing from an average of 2.2 to an average of 5.5. Specific conductivities increased as well between the sites with values of 1,346 umhos/cm at S-18 and 3,078 umhos/cm at S-29.

The Permittee provides additional USGS data collected on Muddy Creek and it's tributaries in the 1970's in Appendix VI-13. At sample location S-1 (See Plate VI-9), located approximately 6 miles north of the permit area, the quality of water in Muddy Creek was found to be very good with an average TDS concentration of 212 mg/l. Downstream at site S-5, before its confluence with Ivie Creek, Muddy Creek's water is noticeably more saline, with a mean TDS concentration of 3,065 mg/l. At site S-6, Ivie Creek dilutes Muddy Creek's waters slightly. The mean TDS concentration decreases to 2,306 mg/l.

Site S-7 represents water collected from an irrigation canal carrying water from Muddy Creek. The equality of this water is very similar to that of Muddy Creek at site S-1. The canal and its associated later drainages service the entire Emery permit area. The water is diverted from a location near S-1. It's reasonable to assume that the water quality of waters sampled at S-1 and S-7 are very representative of the irrigation water utilized in the Emery Mine permit area.

Routine surface water monitoring in the permit and adjacent areas began in 1979. The monitoring plan has been expanded and modified since that time as needed. Data collected from these stations (See Plate VI-4), together with statistical analysis of the data, are provided in Appendix VI-5 and summarized in Table VI-12. The data confirms the conclusions drawn from the previously cited short-term studies on water quality for both Quitchupah Creek and Christiansen Wash.

Monitoring data shows that Quitchupah Creek can be generally characterized as sodium sulfate water, becoming more saline in the downstream direction. At surface water monitoring site (SWMS) 1A, the average TDS concentration during the period of record has been 980 mg/l. Site 1A is located near the upstream edge of the permit boundary. The concentration increases to an average of 1,259 mg/l at SWMS-4, and an average of 1,445 mg/l at SWMS-3 located near the downstream edge of the permit boundary.

The Permittee provides average flows and average TDS concentrations for these sampling sites in Appendices VI-12 and VI-5. The salt load of Quitchupah Creek has increased an average of 11.2 tons per day (TPD) between SWMS-1A and SWMS-1 during the period of record (See Table VI-12). The mine discharges the groundwater it encounters between these sampling points with the salt load from this min-water discharge outfall averaging 4.1 tons per day (TPD) during the period of record 2000 through 2006 (See data for UPDES discharge point 003). The remainder of the increase in salt load in this reach of Quitchupah Creek is attributed to irrigation return flows and natural leaching of saline bedrock and colluvium, particularly that associated with the Blue Gate Member.

Quitchupah Creek's salt load increases by 8.1 TPD between SWMS-1 and SWMS-4. A tributary enters Quitchupah Creek between these sites; carrying irrigation return flows (sampled at SWMS-8) and mine water discharge from UPDES outfall 001. The Permittee calculates a salt load increase of 1.4 TPD from this tributary and 2.0 TPD from the mine water discharge point. The salt load of Quitchupah Creek increases dramatically at SWMS-3. SWMS-3 is located on a reach of Quitchupah Creek that is not influenced by mine-water discharges. It appears that although mine-water discharges increase the salt load of Quitchupah Creek, the majority of the increased salt-load in the stream occurs from irrigation return flows and leaching of naturally saline deposits.

The total dissolved solids (TDS) concentrations are generally highest in local streams during periods of low flow, when dilution is lowest. Conversely, total suspended solids (TSS) are highest during periods of high flow, when the streamflow energy is greatest. TSS and TDS concentrations in mine-water discharge do not exhibit seasonal variations.

The pH of surface water in the permit and adjacent areas is moderately alkaline. All streams included in the water monitoring plan for the mine (Quitchupah Creek, Christiansen Wash and Ivie Creek) can be classified as magnesium-sodium sulfate type at the upstream most monitoring stations and strongly sodium sulfate type at downstream monitoring stations.

Baseline Cumulative Impact Area Information

The application meets the requirements for Baseline Cumulative Impact Area Information as required by R645-301-725. The Permittee provides figures and tables compiling surface and ground water quality and quantity information relative to the permit and adjacent area. The information is sufficient in order to assess the probable cumulative hydrologic impacts of the proposed operation and anticipated mining operations.

Modeling

The application meets the requirements for Modeling as outlined in R645-301-726. The Permittee utilized a groundwater modeling software called MODFLO to estimate water inflow volumes to and discharge volumes from the Emery Mine as well as to estimate the piezometric surface in the Upper Ferron Sandstone aquifer after completion of mining as well as the recovery of the aquifer after mine abandonment. Appendix VI-15 provides a narrative outlining the assumptions built in to the model as well as three scenarios that were run in order to predict future groundwater impacts.

Due to uncertainties of various conditions in the mine area including: changes in Upper Ferron aquifer hydraulic conductivities resulting from the pillaring of the coal and the hydraulic characteristics of the nearby Joe's Valley Fault zone, three different scenarios were run in the MODFLOW model to approximate a range of inflows to the mine.

As a worst-case inflow evaluation, the Permittee assumed that groundwater levels in the Upper Ferron aquifer do not change over time from 2007 going forward, that the hydraulic properties of the Joe's Valley fault zone are much higher than the surrounding strata, and that post-subsidence hydraulic conductivity of the sandstone is on the high side. As water levels in the Upper Ferron aquifer have declined in the vicinity of the mine as mining has progressed, this scenario employs a conservative set of assumptions.

A worst-case drawdown evaluation of the Upper Ferron aquifer was performed in MODFLO as well. It was assumed that groundwater levels in the Upper Ferron aquifer are allowed to decline as mining progresses, that the fault zone has lower hydraulic conductivity than for the high inflow scenario, and that post-subsidence hydraulic conductivity of the sandstone is on the low end of the spectrum. Since water-level declines will likely continue as mining progresses, this scenario is considered to be more realistic than the worst-case inflow scenario discussed above.

A third run of the MODFLO model was performed by a relatively simple calculation of predicted inflow based on inflows measured in the 1st and 2nd South pillared area was used and applied to the remaining areas to be mined. The caveat with this run is that the 1st and 2nd South areas of the mine are near the outcrop and may not be representative of the deeper portions of the mine. The Permittee provides the results of the three scenarios in Table 1.

MODFLO was also utilized to estimate the post-mine closure piezometric surface of the Upper Ferron aquifer. Figures 5 and 6 depict the modeled piezometric surface for the Upper Ferron sandstone for year 2026 (ten years after mining completion and pumping cased) and year 2036 (twenty years after mining completion) respectively. From the figures, it's clear that in the year 2026 the mine is predicted to be nearly full of water to an elevation of 5,975 feet. The MODFLO model demonstrates that the Ferron aquifer is expected to recover significantly soon after the completion of mining. The rate of recovery of the aquifer is most probably due to fairly rapid flooding of the mine because of high recharge rates and the degree of connection between the mine and the overlying aquifer.

Probable Hydrologic Consequences Determination

The application meets the requirements for Probable Hydrological Consequences as required in R645-301-728. Beginning on page VI-16 of the application, the Permittee discusses the potential impacts from coal mining activities on the quality and quantity of surface and groundwater flow within and adjacent to the permit area. The following potential impacts were evaluated:

- Contamination from acid- or toxic-forming materials;
- Increased sediment yield from disturbed areas;
- Impacts to groundwater availability;
- Impacts to surface water availability;
- Increased total dissolved solids concentrations in surface and groundwater;
- Flooding or streamflow alteration;
- Hydrocarbon contamination from above ground storage tanks or from the use of hydrocarbons in the permit area; and
- Contamination of surface water from coal spillage due to hauling operations.

Acid-and Toxic-Forming Materials

On page VI-16 of the application, the Permittee discusses the potential for contamination from acid- or toxic-forming materials. Information regarding acid- and toxic-forming materials in rock at the Emery Mine is presented in Sections VA.4 through V.A.6 of the MRP. The information indicates that the pH of the roof and floor materials of the mine range from 5.0 to 9.1, with the acid-base potential indicating a net base potential. In addition, the pH of the groundwater in the area is typically alkaline (See Section VI.2.4.1).

Rock sample data in Section V.A. 4 indicate that concentrations of trace elements are generally low enough to be considered non-toxic forming. As a result, with the exception of moderate sodium concentrations in some samples, analytical data obtained from the local rock and mine-water discharges indicate that no significant potential exists for the contamination of surface and groundwater in the permit and adjacent areas by acid- or toxic-forming materials.

Increase in Sediment Yield From Disturbed Areas

The Permittee acknowledges that mining and reclamation activities at the Emery Mine have the potential to increase sediment concentrations in the surface waters downstream of the disturbed areas. In order to prevent and mitigate such impacts, the Permittee has implemented sediment-control measures such as sedimentation ponds and diversions as well as alternative sediment control methods where surface drainage is not routed to a sediment pond. On page VI-32 of the application, the Permittee discusses the design details and considerations of the mines sediment control plan. The various siltation structures implemented at the mine have been designed, constructed and maintained in accordance with R645-Coal Mining Rules. Sediment control practices at the mine are utilized within and adjacent to the disturbed areas. Such practices include:

- Retention of sediment within the disturbed area;
- Diversion of runoff away from the disturbed area;
- Diversion of runoff using channels or culverts through disturbed areas to prevent additional erosion;
- Provision of riprap, silt fences, site revegetation, ponds and other measures that reduce overland flow velocities, reduce runoff volumes or trap sediment; and
- Treatment of mine drainage in underground sumps before being discharged to the surface.

Through the utilization of the aforementioned sediment control methods/practices, the likelihood of increased sedimentation to receiving streams within and adjacent to the permit area is minimal.

Each sedimentation pond is designed to work individually to manage the design sediment volume and safely convey the peak discharge rate from its drainage area. Sediment storage and cleanout quantities for each of the mine-water discharge and sedimentation ponds are presented in Table VI-19 of the application. The calculations used to generate these quantity values are presented in Appendix VI-7. The Permittee commits to cleaning out each pond when its actual sediment storage equals 60% of the design volume. The ponds were designed to fully contain the runoff resulting from the 10-year, 24-hour precipitation event. The ponds have been designed to minimize short-circuiting, thus allowing sufficient detention time to achieve effluent limitations. The spillway systems have been designed to safely discharge the peak storm runoff volume generated from a 25-year, 24-hour precipitation event.

Groundwater Availability

Beginning on page VI-17, the Permittee discusses the potential for groundwater to be impacted by mining activity. As noted in the groundwater baseline information presented in section VI.2.4.1, mining activity occurs within the Ferron Sandstone Member of the Mancos Shale.

Groundwater has the potential to enter the mine through both the floor and roof from the permeable, saturated Ferron Sandstone. Hydrographs depicting the water-level data for the Ferron Sandstone (See Figures VI-4 through VI-7) show that water level declines have occurred in all three sections of the Ferron Sandstone (Upper, Middle and Lower sections). However, the data presented in Plates VI-7 and VI-8 indicate that the greatest water level declines have occurred in the Upper Ferron Sandstone member. Shales that constitute the floor of the mine impede significant upward leakage from the Middle and Lower Ferron Sandstone. In-mine observations have also verified that the majority of inflow encountered in the mine occurs from the roof rather than the floor.

As the mine encounters water, the flow pattern within the Ferron Sandstone is altered. The alteration causes groundwater level declines in the area of the mine. As the primary route to the mine is through the roof of the workings, the Upper Ferron Sandstone is the most subject to water level declines. In an effort to estimate groundwater level declines in the Upper Ferron Sandstone, the Permittee utilized the USGS MODFLO program. MODFLO was used to calculate water inflow volumes to and discharge volumes from the Emery Mine, as well as to estimate the potentiometric surface in the Upper Ferron Sandstone aquifer after the completion of mining as well as it's recovery.

Due to uncertainties such as the distributions of vertical and horizontal hydraulic conductivities, recharge rates as well as boundary conditions, differing scenarios were run with the MODFLOW model to approximate a range of inflows rather than a single value. A worse case inflow scenario was run that assumed that groundwater levels in the Upper Ferron aquifer do not change over time, that the hydraulic properties of the Joe's Valley fault zone are much higher than the surrounding strata and that post-subsidence hydraulic conductivities are high. The scenario would assume the greatest amount of recharge to the aquifer and thus inflow to the mine.

A worse case drawdown scenario was modeled as well. It was assumed that groundwater levels in the Upper Ferron aquifer are allowed to decline as mining progresses, that the fault zone has lower hydraulic conductivity than for the high inflow scenario, and that post-subsidence hydraulic conductivity of the sandstone is on the low side. Assuming that water level declines in the Upper Ferron will likely continue as mining progresses, this scenario is considered a more realistic estimate than the worse case inflow scenario outlined above.

A third run of the MODFLO model was done as an independent check to the modeled inflows obtained from the two scenarios described above. The calculation was based on inflows measured in the 1st and 2nd South pillared areas. These measured inflows were then applied to the remaining areas to be mined. It's important to note that the 1st and 2nd South areas are near the outcrop and may not be representative of the deeper portions of the mine.

A comparison of Plates VI-1, *Upper Ferron Sandstone Potentiometric Surface (1979)*, with Plate VI-7, *Upper Ferron Sandstone Potentiometric Surface (2006)* clearly show that the potentiometric surface of the Upper Ferron Sandstone has been affected by mining activity. The declines in the Upper Ferron are more pronounced within the existing permit area, with decreasing impacts to the water levels as you move away from the mine workings (See Plates VI-1 and Plate VI-7). Plate VI-1 shows that groundwater movement in the Upper Ferron Sandstone was generally southeastward through the permit area prior to mining activity. As mining activity began, mine dewatering created a trough of depression. The trough of depression causes the groundwater to flow toward the center of the permit area under current conditions (See Plate VI-7). The trough of depression currently extends throughout the permit area and much of the adjacent areas. The groundwater modeling results discussed above, indicate that the area of impact to groundwater levels will continue as long as mine dewatering activities continue. Once in-mine pumping operations are terminated and as groundwater levels return to their approximate pre-mining elevations, pre-mining groundwater flow directions will also be re-established. By comparing Plate VI-1, Upper Ferron Sandstone Potentiometric Surface (1979) with Figure 6 of Appendix VI-15, it's evident that groundwater flow directions in the Upper Ferron Sandstone (the most impacted of the three Ferron Sandstone layers) will return to approximate pre-mining conditions following the cessation of pumping operations.

As the mined coal layer is primarily located in the Upper Ferron sandstone layer, mining activity at the Emery Deep facility produces much less of a dramatic impact on the Middle and Lower Ferron Sandstone layers. Upon comparing Plate VI-2, *Lower Ferron Sandstone Potentiometric Surface* (1985) and Plate VI-8, *Lower Ferron Sandstone Potentiometric Surface* (2006), it appears that the general shape and elevations of the potentiometric surface of the Lower Ferron Sandstone has remained relatively constant since 1985.

Appendix VI-15 provides the results of the MODFLO modeling effort described above. Data presented in Appendix VI-15 indicates that the potentiometric surface of the Upper Ferron Sandstone will gradually return to pre-mining conditions once pumping activities are terminated. Based on the data presented in Appendix VI-15, it is predicted that groundwater levels will recover to within 50 to 60 feet of pre-mining conditions approximately 10 years following the cessation of pumping activities. It is further predicted by the MODFLO model that groundwater levels in the Upper Ferron Sandstone will recover to within approximately 30 feet of pre-mining conditions throughout most of the permit area within 20 years following the cessation of pumping operations (Compare Plate VI-1 with Figure 6 in Appendix VI-15). Comparing Figures 5 and 6 (Upper Ferron Sandstone Piezometric Surface for Years 2026 and 2036 respectively) with Figure 4 (Upper Ferron Sandstone Piezometric Surface for 2016) demonstrate that the Upper Ferron Aquifer is expected to recover significantly within a relatively short period time following the completion of mining activity.

Based on historical groundwater data for the permit and adjacent area, artesian conditions within the Ferron Sandstone were present prior to mining activity. Artesian conditions in the western portion of the permit area were such that some wells flowed at the surface prior to mining. The MODFLO model indicates that it is unlikely that artesian conditions will return within 20 years after mining.

As noted in Table VI-1, the town of Emery has water rights at two wells (Emery Town Wells #1 and #2) located approximately 14,500 feet north of the permit boundary. The Emery Town wells are located approximately 3.6 miles from the mine and are up gradient within the regional ground water flow pattern. Based upon Utah Division of Water Rights data, Well #1 is completed in the lower Ferron Sandstone while Emery Well #2 is completed in the Middle/Upper Ferron Sandstone. Based upon the cone of depression created by in-mine dewatering activities (See Discussion Above), the Permittee was advised to look at the potential for mining activity to impact the Emery Town wells. The application states that the driller's log for Well #2 indicates that the static water level was 91 feet below ground surface in October 1979. A water level measurement obtained from Well #2 in November 2007 indicated a depth to water of 85 feet. It would appear from the water level data that there has not been an impact to the water levels at the Emery Town Wells at this time. The wells serve as a backup domestic water supply system to the town of Emery. As such, the Permittee has committed to evaluate data collected from the Emery town wells, using hydrographs and other appropriate means, and submit a report of the findings to the Division on a semi-annual basis.

Impacts to surface water availability

Beginning on page VI-21, the Permittee discusses impacts to surface water availability. As in the past, water removed from the mine will be discharged to Quitchupah Creek, thus increasing the flow of the receiving stream. USGS stream gauging data collected on Quitchupah Creek near the mine office from 1978 through September 1981 produced an average flow of 8.43 cfs and a range from 6.73 to 10.8 cfs (See Appendix VI-11). Mine-water discharge rates predicted by the MODFLO model and mass balance calculations range from 1.35 cfs to 3.20 cfs. These values represent a 16 to 38% increase in the above-noted average annual flow of Quitchupah Creek. In addition, no discharges have been observed to from the Emery Mine sedimentation ponds. As a result, a small quantity of runoff is precluded from reaching Quitchupah Creek and Christiansen Wash if the mine surface facilities did not exist. However, given the small amount of precipitation in the area and the relatively small area of the surface facilities, this reduction in stream flow for Quitchupah Creek and Christiansen Wash is very likely minimal. Thus, the net effect of mining on the availability of surface water in the immediate area is an increase in the flow of Quitchupah Creek and downstream waters.

In Section VI.2.4.2 of the application, the Permittee discusses several factors that have a direct effect on the stream flow of Quitchupah Creek and Christiansen Wash. These drainages are influenced by direct irrigation return flow of water originating from Muddy Creek, groundwater discharge from the Ferron Sandstone, discharge from the Emery Mine as well as overland flow from precipitation runoff. It's assumed that interception of water in the mine will produce a local decrease in base flow for Christiansen Wash and Quitchupah Creek, however due to the aforementioned factors, it's difficult to accurately predict the magnitude of this impact.

Plate V-5, Subsidence Monitoring Points and Buffer Zones, depicts the locations of buffer zones established by the Permittee that preclude full extraction mining beneath Christiansen Wash and Quitchupah Creek. As a result, direct impacts to the streambed of these two surface waters are not anticipated. However, subsidence could impact irrigation ditches and stock-watering ponds in areas overlying full extraction panels. Impacts to irrigation ditches could include changes in gradients that might produce depressions that cause ponding in areas that would otherwise flow. In addition, cracks could develop in ditch and pond embankments, resulting in seepage outside of the embankments.

Two conditions exist that would serve to minimize the amount of water that could be diverted from irrigation ditches and stock watering ponds to the mine as a result of subsidence. First, the Blue Gate member of the Mancos Shale, which exists between the surface and the coal zone through the area, contains bentonitic clays (U.S. Geological Survey, 2007). As a result, subsurface cracks will swell and seal when water enters the crack. Secondly, irrigation ditches and ponds in the area typically contain water only ephemerally, minimizing the time that surface water may come into contact with a crack. In the event that subsidence from full extraction mining impacts these irrigation networks and stock watering ponds, the Permittee has provided a commitment to promptly replace any state appropriated water supplies should they be altered (See Page V-42).

Increased total dissolved solids concentrations in surface and groundwater

The Permittee discusses the potential of increased total dissolved solids (TDS) concentrations in surface and groundwater beginning on page VI-22 of the application. Table VI-16 provides a comparison of average water quality data collected from the Ferron Sandstone and the Emery Mine. According to the data, the average TDS concentration of water entering the mine (as measured in roof samples) is 1,025 mg/L. The average concentration of water discharging from the mine to Quitchupah Creek (as measured at UPDES outfalls 001 and 003) and reported in Table VI-16 is 3,110 mg/L. These data indicate that TDS concentrations increase by a factor of 3.0 for water flowing through the mine. The Permittee indicates that the increase is likely the result of dissolution of gypsum rock dust used in the mine.

A TMDL study of the Muddy Creek Watershed indicated that Muddy Creek and it's major tributaries (including Quitchupah Creek) would not support an agricultural beneficial use classification (MFG, 2004). The lack of beneficial agricultural use occurs at the location where the streams cross State Highway 10 (i.e. upstream of the mine water discharge points). The TMDL study concluded that elevated TDS concentrations in areas downstream from Highway 10 are caused predominantly by changes in surficial geology (i.e. outcropping of the saline Mancos Shale) and irrigated agriculture (return flows).

The Permittee cites a 2003 U.S. Bureau of Reclamation report that states the Muddy Creek watershed salt load average is 86,000 tons/yr. The Emery Mine's current UPDES permit allows a maximum salt load of 12 tons/day to be discharged form the mine. Assuming that this salt load is discharged constantly throughout the year, the annual salt load from the mine to the Muddy Creek watershed would be 4,380 tons/yr (approximately 5% of the basin-wide salt load). Per conversations with Department of Water Quality personnel, it's expected that the UPDES permit salt-load limit will change in the future from 4,380 tons/yr. to 3,839 tons/yr.

In addition, no surface water rights exist on Quitchupah Creek downstream from the mine-water discharge points, nor do they exist on Ivie Creek between the confluence of Quitchupah Creek and Muddy Creek. As a result, no significant water-quality impacts to downstream water users are anticipated.

Flooding or streamflow alteration

The Permittee discusses the potential for flooding and/or streamflow alteration beginning on page VI-24. Storm water runoff from all disturbed areas is directed through sedimentation ponds or other sediment-control devices prior to discharge to adjacent undisturbed drainages. The Permittee outlines three factors that the implemented sediment control devices minimize or preclude flooding impacts to downstream areas as a result of mining operations:

- The sediment control measures have been designed and constructed to be geotechnically stable, thus minimizing the possibility of the devices to be breached or fail and thus cause downstream flooding.
- The sediment control measures have been sized such that no discharges have been recorded.
- By retaining sediment on site, the bottom elevations of stream channels downstream from the disturbed areas are not artificially raised. Thus, the hydraulic capacity of the streams channels is not altered and flooding potential is further precluded.

In addition, as previously discussed, stream buffer zones have been established on both Christiansen Wash and Quitchupah Creek. The buffer zones preclude full extraction mining underneath the stream channels, thus minimizing the possibility of subsidence causing flood impacts to these drainages. As such, the mine has been designed to preclude subsidence in areas occupied by perennial streams (See Plate V-5 for the locations of the buffer zones). No alteration of streamflow is anticipated in the perennial drainages.

The Permittee does identify the potential for subsidence to impact ephemeral stream channels. Subsidence will occur in areas occupied by ephemeral stream channels. Ephemeral stream flows may be partially intercepted by subsidence cracks prior to the completion of the healing process on those fractures. Furthermore, the broad depressions created by subsidence may locally retain runoff that would normally discharge from an area. However, there are three factors that indicate that the impact of subsidence on ephemeral streamflow would be minimal:

- Ephemeral streamflow in the area is sporadic, allowing significant periods of time for surface cracks to heal between flow events.
- Ephemeral streamflow typically carries a high sediment load. The sediment will fill the remaining cracks. As the cracks heal, the potential for interception of streamflow is minimized.
- The depressions caused by subsidence are sufficiently broad that the changes in slope are not typically pronounced enough to cause significant ponding.

Potential hydrocarbon contamination

The Permittee discusses the handling of hydrocarbon products beginning on page VI-24. The potential for hydrocarbon contamination will be minimal. Tanks that store hydrocarbon products are located above ground. As such, spills can be readily detected and repaired. In addition, the mine as a Spill Prevention Control and Countermeasure Plan in place that provides inspection, training and operation measures to minimize the extent of contamination resulting from the use of hydrocarbon products at the site.

Contamination of surface water from coal spillage due to hauling operations.

The Permittee discusses the potential for coal spillage during hauling beginning on page VI-25. The Permittee states, "Past experience has indicated that no substantial quantities of coal have been spilled during transport." However, if coal is spilled, it could wash into local streams during a runoff event prior to cleanup. The probability of such a spill occurring in an area sufficiently close to a stream channel to introduce coal to the streambed is minimal.

Findings:

The application meets the requirements of R645-301-728.

MAPS, PLANS, AND CROSS SECTIONS OF RESOURCE INFORMATION

Regulatory Reference: 30 CFR 783.24, 783.25; R645-301-323, -301-411, -301-521, -301-622, -301-722, -301-731.

Analysis:

Monitoring and Sampling Location Maps

The application meets the requirements for Monitoring and Sampling Location Maps as required by R645-301-731. Plate VI-4, *Ground Water Monitoring Well and Surface Water Monitoring Site Locations*, depicts the locations of all surface and groundwater monitoring points both within and adjacent to the permit area.

Subsurface Water Resource Maps

The application meets the requirements for Subsurface Water Resource Maps as required by R645-301-731. Plate VI-1 depicts the potentiometric surface of the Upper Ferron Sandstone aquifer as of 1979. Plate VI-2 depicts the potentiometric surface of the Lower Ferron Sandstone aquifer as of 1985. Plates VI-7 and VI-8 depict the potentiometric surface of the Upper and Lower Ferron Sandstone respectively for 2006. Plate VI-3 depicts the water rights located within and adjacent to the permit area.

Surface and Subsurface Manmade Features Maps

The application meets the requirements for Surface and Subsurface Manmade Features Maps as required by R645-301-731. Plate VI-4 depicts all surface and subsurface manmade features located within and adjacent to the permit area.

Surface Water Resource Maps

The application meets the requirements for Surface Water Resource Maps as required by R645-301-731. Plate VI-4 depicts all surface water located within and adjacent to the permit area.

Well Maps

The application meets the requirements for Well Maps as required by R645-301-731. Plate VI-4 depicts all groundwater wells (including monitoring wells) located within and adjacent to the permit area.

Findings:

The application meets the Maps, Plans and Cross Sections of Resource Information requirements of the State of Utah R645-Coal Mining Rules as outlined in R645-301-722, -731.

OPERATION PLAN

SUBSIDENCE CONTROL PLAN

Regulatory Reference: 30 CFR 784.20, 817.121, 817.122; R645-301-521, -301-525, -301-724.

Analysis:

Renewable Resources Survey

The application meets the requirements for Renewable Resources Survey as required in R645-301-724.

Appendix V-4 in Chapter V of the permit provides a pre-subsidence survey for the areas overlying the 14th and 15th West panels. The report was prepared by EarthFax engineering in April 2007 and submitted during a previous permitting action that called for full extraction of the 14th West Panel. Due to the close proximity of the two panels (14th and 15th West), the pre-subsidence survey was conducted on both.

Figure 1 of Appendix V-4 depicts the 14th and 15th west panels within the Emery Mine permit area. Several ephemeral and intermittent drainages are located within the 14th and 15th west panel orientation. In addition, a buried 8" water line is located directly adjacent to a road that has been designated as "light duty, hard or improved surface". The water line is connected to the Town of Emery's water tower. The water is utilized at the mine-site for culinary purposes. Number 30 as depicted on Figure 1 corresponds to a former pond embankment. In the 1980 Valley Engineering report, site number 30 was identified as a functioning pond utilized for irrigation diversion purposes. The embankment is no longer functioning. According to the report, the center portion of the embankment has been eroded away. A photo of the former embankment is provided within the report.

The Permittee provides a pre-subsidence survey of the Zero North, 4th East mains and 6th West panels in Appendix V-5. The report was prepared by EarthFax Engineering and is dated October 2007. The report provides the locations and descriptions of the following features: structures (e.g. buildings, corrals, roads), fences, utilities (e.g. power, telephone, gas, water lines and water wells) as well as surface drainages (e.g. natural channels, irrigation ditches). Appendix V-5, Figure 1, Pre Subsidence Survey Update, 4 East Mains, Panel 6 West and Zero North, depicts irrigation ditches overlying areas of the 6th West and Zero North Panels (#122 and #123 respectively on the figure).

Feature #122 consists of an irrigation ditch that conveys water from north to south along the west side of the road described in Feature #97 of the report as well as along the northwest edge of an irrigated field adjacent to the road. The ditch is described as approximately six inches deep and in fair to good condition. Survey coordinates associated with this ditch were obtained by the Permittee and provided in Table 1 of the report.

Feature #123 is identified as a "remnant irrigation ditch segment". It's comprised of a segment of an irrigation ditch that has fallen into disrepair. The ditch contains a section of irrigation piping. The report describes both the ditch and the piping as having mostly filled in with sediment with the inflow and outflow to and from this ditch segment completely filled in. Survey coordinates associated with this ditch were obtained by the Permittee and provided in Table 1 of the report.

A previous technical analysis of the amendment had identified a deficiency in Figure 1 of Appendix V-5. The legend of the figure had depicted a solid red line as a culvert. There were several solid red lines depicted on the figure that did not correspond to culverts. Field investigations conducted by Division staff had not identified culverts in the locations depicted on the map by a solid red line. Upon further review and phone conversations with Consol representatives, it was determined that the solid red lines depicted on Figure 1 of Appendix V-5 are property boundaries. The Permittee modified Figure 1 so the property boundaries and culverts are distinguished from one another.

Subsidence Control Plan

The application meets the Operational Plan requirements for Subsidence Control Plan as provided in R645-301-525.120, -525.480

Section V.B of the MRP discusses subsidence monitoring. Page 36 of the MRP outlines the steps and elements of the proposed subsidence-monitoring plan. The plan calls for the establishment of a series of reference points to be established outside the theoretical angle of draw. Item 1A on page 36 calls for a mine representative to inspect monthly the areas designated as "full extraction" on Plate V-5. The monthly inspections will continue until the survey monitoring points below indicate that there is no subsidence occurring. A record of the monthly inspections will be produced and forwarded to the Division. A copy of the inspection will also be kept at the mine office.

In addition, the Permittee has committed to establish pre-mining elevations and gradients of any irrigation ditches and pond embankments within the angle of draw (See Item 11 in chapter V page 37). The Permittee will also monitor these areas by visual inspection and post-subsidence ground survey to establish the effects of subsidence. The Permittee has committed to providing the Division with a quarterly subsidence mitigation report that describes the surface mitigation projects and their status broke down by surface landowner.

Subsidence mitigation efforts are further discussed on pages 39-42 of Chapter V of the approved MRP. Pages 41 and 42 of the approved MRP generally discuss timetables and how the Permittee will work with landowners and the Division regarding mitigation efforts. On page 39 of Chapter V of the approved MRP, the Permittee discusses the mitigation process relative to subsidence damage to structures and State appropriated water supplies. The Permittee commits to "restore, rehabilitate or remove and replace, to the extent technologically and economically feasible, each materially damaged structure, feature or value".

Page 41 in Chapter V of the MRP discusses subsidence mitigation. The Permittee states, "If subsidence occurs which prevents flow through a ditch that is used each summer, then it will be necessary to repair the ditch as soon as practical even though future subsidence may necessitate further work".

In addition, the mine has been designed to preclude subsidence in areas occupied by perennial streams. The Permittee has produced a plan to prevent subsidence from affecting Quitchupah Creek, Christiansen Wash and the alluvial valley floor area on the west side of the permit area by establishing buffer zones in these areas. Plate V-5, *Subsidence Monitoring Points and Buffer Zones*, depicts a stream buffer zone extending the full length of Christiansen Wash in the areas where full extraction mining will take place. Additionally, a buffer zone has been established in the alluvial valley floor area around Quitchupah Creek. The overburden depth and the angle of draw were used to determine the buffer zone dimensions. The buffer zone for Quitchupah Creek and Christiansen Wash includes an additional standoff distance of 100 ft. on either side.

The Permittee provides further clarification on subsidence mitigation on page 39 of the MRP. The Permittee commits to "mitigate the damage in accordance with R645-301-525.500" and that "the mitigation process will be performed in accordance with R645-301-731.530, R645-301-525.520 and R645-301-525.530". R645-301-731.530 calls for the prompt replacement of any state appropriated water supply that is contaminated, diminished or interrupted by underground coal mining and reclamation activities. R645-301-525.520 and R645-301-525.530 deal with the mitigation of any structures that are impacted by mining activity

The Permittee provides a commitment to "repair or replace any adversely affected State appropriated water supplies that are contaminated, diminished or interrupted" as required by R645-301-731.530 on page 41 of Chapter V of the MRP.

Per R645-301-731.530, the Permittee is required to promptly replace any State-appropriated water supply that is contaminated, diminished or interrupted by underground coal mining and reclamation activities. On page V-42 of the application, the Permittee outlines water replacement measures to be initiated in the event that mining activity was to impact the Emery Town Wells. If the town of Emery surface water system (Muddy Creek) becomes inoperable and the backup wells (Wells #1 and #2) have been impacted by mining activity, the Permittee provides a commitment to "hauling water to the Emery treatment facility until the towns surface system becomes operable, an alternative source is secured or the aquifer recharges".

Findings:

The application meets the hydrologic requirements for Subsidence Control Plan as required by the R645-Coal Mining Rules.

SPOIL AND WASTE MATERIALS

Regulatory Reference: 30 CFR Sec. 701.5, 784.19, 784.25, 817.71, 817.72, 817.73, 817.74, 817.81, 817.83, 817.84, 817.87, 817.89; R645-100-200, -301-210, -301-211, -301-212, -301-412, -301-512, -301-513, -301-514, -301-521, -301-526, -301-528, -301-535, -301-536, -301-542, -301-553, -301-745, -301-746, -301-747.

Analysis:

Refuse Piles

The application contains the design data, maps and hydrologic model runs used to design the drainage system at the existing refuse pile site. R645-301-746.212, as stated above, requires that runoff from a refuse pile must be diverted into stabilized diversion channels that are designed to safely pass the runoff from a 100-year, 6-hour event. Upon review of the submitted model, as well as the surface drainage map, the drainage network at the current refuse pile location meets this requirement.

In addition as part of the technical review associated with NOV #100015, the Permittee designed a permanent refuse disposal site. The site has been designed to safety pass the 100-year, 6-hour event. Storm water runoff generated from the site will be diverted in to Pond No. 8. The Permittee has demonstrated that Pond No. 8 has adequate storage capacity to safely contain the storm water runoff generated from the permanent refuse disposal site.

Findings:

The submittal meets the Refuse Pile requirements of R645-301-746.212.

HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

Analysis:

General

The application meets the Operational Plan requirements for General Hydrologic information as provided in R645-301-731.

Chapter VI of the approved MRP discusses the hydrologic resources within the 14th and 15th west panel areas as well as the Zero North, 4th East and 6th West panels; including ground and surface water information, water uses, water rights as well as the probable hydrologic consequences of full extraction mining within the permit area.

The coal to be mined is located within the upper portion of the Ferron Sandstone. The Permittee discusses the recharge and a discharge rate of the Upper Ferron Sandstone layer and indicates that the dewatering of the Emery Mine represents the largest anthropogenic discharge of groundwater from this geologic unit.

The MRP outlines the measures to be taken during the operational mining phase to minimize disturbance of the hydrologic balance within and adjacent to the permit area as well as prevent material damage to the hydrologic balance.

Groundwater Monitoring

The application meets the Operational Plan requirements for Groundwater monitoring as provided in R645-301-731.210. The Permittee does not propose any additional ground water monitoring within the 14th, 15th panels, nor within the area of the Zero North, 4th East and 6th West panels. Emery Town Wells #1 and #2 will be monitored quarterly upon approval of this amendment. Plate VI-4 of the application depicts the current ground water monitoring wells within the permit area as well as adjacent to it.

Upon review of historical groundwater data as well as the continuing groundwater monitoring data supplied to the Division, it's clear that the Ferron Sandstone aquifer will continue to be dewatered as a result of the proposed mining activity at the Emery Deep facility. Emery Town wells #1 and #2 are completed within the Ferron Sandstone aquifer and serve as back up culinary water sources for the town. In order to determine what (if any) impact mining activity has on these wells, quarterly monitoring will begin with the approval of this application. Plate VI-4, *Ground Water Monitoring Well and Surface Water Monitoring Site Location Map*, depicts the Emery Town wells as slated for quarterly field and water quality monitoring. The Emery Town wells have also been added to Table VI-17 Emery Mine Hydrologic Monitoring Program. The wells are slated for quarterly field and water quality sampling. Table VI-17 provides a brief discussion as to the physical limitations to sampling the wells. The pump in Well #1 is functional, but there is no means to measure water levels in this well. The pump in

Well #2 is not functional, but an airline exists by which water levels can be measured. As a result, water quality samples will be collected from Well #1 and water-level measurements will be collected from Well #2.

In order to insure that any potential mining impacts to the Emery Town Wells is detected as early as possible, the Permittee has committed to evaluate the collected data from the Emery Town wells and submit semiannual reports to the Division.

The Permittee provides comprehensive water monitoring information as to the specific ground and surface water sites and their respective monitoring protocols in Table VI-17, *Emery Mine Hydrologic Monitoring Program.*

Surface Water Monitoring

The application meets the Operational Plan requirements for Surface Water Monitoring as provided in R645-301-731.220. Additional surface water monitoring within the 14th West, 15th West, Zero North, 4th East and 6th West panel areas is not necessary. Plate VI-4 of the application depicts the surface water monitoring points within the permit area as well as adjacent to it. Table VI-17, *Emery Mine Hydrologic Monitoring Program* provides the sampling protocols for all ground and surface water sites within the permit and adjacent area.

Water-Quality Standards And Effluent Limitations

The application meets the requirements for Water-Quality Standards and Effluent Limitations as outlined in R645-301-751. The Permittee operates under a UPDES discharge permit (#UT0022616) issued by the Utah Division of Water Quality (DWQ) and controls discharges from the mine to be consistent with that permit. The Emery Mine UPDES permit currently allows a maximum salt load of 12 tons/day to be discharged from the mine. If this load were discharged constantly throughout the year, the annual salt load from the mine to the Muddy Creek watershed would be 4,380 tons/year. Upon discussions with DWQ personnel, it's anticipated that the salt-load limit will change to approximately 3,839 tons/year.

Diversions:

The application meets the requirements for Diversions as required in R645-301-732.300, 742.100, 742.200, 742.300, 742.320 and 742.330. The drainage ditch designs consist of a narrative description, design parameters, flow calculations, flow line profiles and cross-sections for each ditch. The Permittee incorporated design parameters including: drainage area calculations, design storm information, curve numbers and channel dimensions.

The design storms used for the ditches were a 10-year/24-hour event for temporary ditches (not associated with refuse disposal areas) and a 100-year/24-hour event for permanent stream diversions, waste disposal site diversion and ditches associated refuse disposal areas. The ditches have been designed to maintain flow velocities during design storm event peak flows under 4.0 feet per second (fps) in earthen channels and less than 12 fps in rock lined channels. The Permittee has committed to utilizing rock checks and/or other stabilizing structures in earthen channels where gradient slopes result in peak velocities exceeding 4.0 fps. In addition, channel bottoms will armored with rock riprap where necessary.

All diversions are depicted on Surface Drainage Control Maps Plates VI-10, VI-10A, VI-10B and VI-10C. Table VI-18 provides a summary of the operational diversion ditches and culverts at the mine site. The table provides design criteria utilized in the sizing of the ditches including: bottom width, side slopes, design flow depth and the design storm event. Detailed design calculations and drawings are presented in Appendix VI-6 of the MRP.

The Permittee constructed a crossing over Quitchupah Creek in the late 1970's using a multi-plate arch on a concrete foundation. The structure consists of concrete wing walls and was equipped with a guardrail. The crossing was installed to allow access to the stockpile area south of Quitchupah Creek. It replaced two 3-foot diameter culverts, which were determined to be undersized for design flood conditions. The design information for this structure is provided in Appendices IV-7 and IV-8.

Stream Buffer Zones

The application meets the Stream Buffer Zone requirements as provided in R645-301-731.600. Page VI-27 discusses stream buffer zones. Plate V-5, Subsidence Monitoring Points and Buffer Zones, depicts the location of stream buffer zones established on both Christiansen Wash and Quitchupah Creek. All perennial and intermittent streams in the permit area are protected by 100-foot stream buffer zones on either side of these streams. Coal mining and reclamation operations have been designed to minimize any adverse affects on water quantity and quality for these receiving streams. Areas surrounding the streams that are not to be disturbed are designated as buffer zones, and the Permittee has marked these areas as specified in R645-301-521.260.

Sediment Control Measures

The application meets the Sediment Control Measure requirements as provided in R645-301-732. On page VI-32, the application discusses the various sediment control measures implemented at the site. The sediment control measures have been designed, constructed and maintained to accomplish the following:

- Prevent additional contributions of sediment to stream flow or to runoff outside the permit area;
- Meet the effluent limitations defined in Section VI.5.1; and
- Minimize erosion to the extent possible.

The sediment control plan includes:

- Retention of sediment within the disturbed area;
- Diversion of runoff away from the disturbed area;
- Diversion of runoff using channels or culverts through disturbed areas to prevent additional erosion;
- Provision of riprap, silt fences, site revegetation, ponds and other measures that reduce overland flow velocities, reduce runoff volumes, or trap sediment; and
- Treatment of mine drainage in underground sumps prior to being discharged to the surface.

The Permittee also utilizes a number of alternative sediment control methods for surface drainage that does not pass through a sedimentation pond. Details regarding the alternative sediment controls are provided in Appendix VI-8. Table VI-21 provides the locations of the alternative sediment controls that have been installed at the mine site. Alternative sediment control measures installed at the site include: runoff collection berms, rock check dams, silt fences and vegetative cover.

Siltation Structures: Sedimentation Ponds

The application meets the Siltation Structures: Sediment Ponds requirements as provided in R645-301-732.200 and –742.220. The mining operation utilizes 5 sedimentation ponds, not including the 3 mine-water discharge ponds. Discussion of the design of the mine-water discharge and sedimentation ponds are discussed in Section VI.4.2.2 of the MRP.

The sedimentation ponds were designed to provide treatment or full containment of the total runoff volume from a 10-year, 24-hour precipitation event. The sedimentation ponds were constructed with a dewatering system consisting of slide gates that remain closed except when dewatering. Dewatering of these ponds occurs after a minimum of 24 hours of storm water detention is provided to achieve effluent limitations. A registered professional engineer certified all sedimentation ponds at the Emery Mine after construction with as-built drawings submitted and approved by the Division. In addition, all ponds are inspected in accordance with applicable regulations.

Plans and cross sections associated with the sedimentation and mine-water discharge ponds are located provided on Plates VI-14 through VI-20, Plate VI-20A and Appendix VI-7 of the approved MRP. Each plan is designed to work individually to manage the design sediment volume and safely convey the peak discharge rate from its respective drainage area. All sedimentation ponds are located as near as possible to the disturbed areas that report to them.

Sediment storage and cleanout quantities (i.e. volumes and elevations) are presented in Table VI-19. The calculations utilized to generate these quantities are presented in Appendix VI-7. The Permittee commits to clean out each pond when its actual sediment storage equals 60% of the design volume.

Discharge Structures

The application meets the Discharge Structures requirements as provided in R645-301-734, -744. Page VI-29 of the application discusses the spillway designs of the sedimentation ponds. The spillways were designed to safely discharge the peak runoff from a 25-year, 24-hour precipitation event. The design of the spillways incorporates a minimum of 1.0 feet of freeboard above the peak water surface to the crest of the pond embankment. The Permittee commits to controlling the discharge from the sedimentation ponds by riprap and other methods on page VI-29.

Ponds, Impoundments, Banks, Dams, and Embankments

The application meets the requirements for Ponds, Impoundments, Banks, Dams and Embankments as required by R645-301-536.800 and-744.100. The embankments are discussed on page VI-29 of the application. The embankments were designed and constructed to maintain a combined upstream and downstream slope of not less than 1v: 5h, with neither slope steeper than 1v: 2h. The Permittee has committed to utilizing rock checks and/or other stabilizing structures in earthen channels where gradient slopes result in peak velocities exceeding 4.0 fps. In addition, channel bottoms will be armored with rock riprap where necessary.

It should be noted that during the construction of the sedimentation ponds, the embankment materials were free of sod, large roots, frozen soil and acid- or toxic-forming coal processing waste. The embankments were compacted during placement of the materials.

Findings:

The application meets the requirements for Hydrologic Information as required by the R645-Coal Mining Rules.

MAPS, PLANS, AND CROSS SECTIONS OF MINING OPERATIONS

Regulatory Reference: 30 CFR Sec. 784.23; R645-301-512, -301-521, -301-542, -301-632, -301-731, -302-323.

Analysis:

Surface Drainage Control Maps

The application meets the Maps, Plans and Cross Sections of Mining Operations requirements as outlined in R645-301-731. The application provides updated surface drainage control maps. Plate VI-10 is an index plate that shows the locations of the remaining four surface drainage maps (VI-10A – VI-10D). The drainage maps depict the various elements/features of the mines surface drainage control plan. The maps depict the sediment ponds, culverts, ditches and other sediment control measures utilized at the site to control disturbed area drainage and handle the in-mine water discharge.

The Permittee has field verified the various drainage components utilized at the mine sites disturbed areas.

Monitoring and Sampling Location Maps

The application meets the requirements as provided in R645-301-731. Plate VI-4, Ground Water Monitoring Well and Surface Water Monitoring Site Location Map has been revised to depict the Emery Town Wells (#1 and #2) as being monitored quarterly as requested by the Division.

Findings:

The application meets the Maps, Plans and Cross Sections of Mining Operations requirement as provided in R645-301-731.

RECLAMATION PLAN

GENERAL REQUIREMENTS

Regulatory Reference: PL 95-87 Sec. 515 and 516; 30 CFR Sec. 784.13, 784.14, 784.15, 784.16, 784.17, 784.18, 784.19, 784.20, 784.21, 784.22, 784.23, 784.24, 784.25, 784.26; R645-301-231, -301-233, -301-322, -301-323, -301-331, -301-333, -301-341, -301-342, -301-411, -301-412, -301-422, -301-512, -301-513, -301-521, -301-522, -301-525, -301-526, -301-527, -301-528, -301-529, -301-531, -301-533, -301-534, -301-536, -301-537, -301-542, -301-623, -301-624, -301-625, -301-626, -301-631, -301-632, -301-731, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-732, -301-733, -301-746, -301-764, -301-830.

Analysis:

The application meets the General Requirements for Reclamation as provided in R645-301-760. Discussion of the reclamation plan begins on page VI-38 of the application. A detailed description of the reclamation plan is provided in Chapter III. The Permittee ensures that all temporary structures will be removed and reclaimed. No permanent sedimentation ponds, diversions, impoundments or treatment facilities are anticipated under the reclamation plan. The Permittee has committed to restoring all natural drainage patterns during reclamation. All cut and fill slopes will be reshaped to be compatible with the post-mining land use and to complement the drainage pattern of the surrounding terrain.

On page VI-38, the Permittee states, “All siltation structures will be maintained until removed in accordance with the approved reclamation plan.” When a siltation structure is removed, the land on which the siltation structure was located will be regarded and revegetated in accordance with the reclamation plan presented in Chapter III.

On page VI-39 the Permittee addresses the permanent casing and sealing of monitoring wells. When no longer needed for monitoring or other use approved by the Division or unless approved for transfer as a water well, each monitoring well or borehole associated with the Emery Mine will be capped, sealed, backfilled or otherwise properly managed as required by the Division. Permanent closure measures will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, machinery and to keep acid- or toxic-drainage from entering ground or surface waters.

Findings:

The application meets the Reclamation requirements as provided in the R645-State of Utah Coal Mining Rules.

APPROXIMATE ORIGINAL CONTOUR RESTORATION

Regulatory Reference: 30 CFR Sec. 784.15, 785.16, 817.102, 817.107, 817.133; R645-301-234, -301-412, -301-413, -301-512, -301-531, -301-533, -301-553, -301-536, -301-542, -301-731, -301-732, -301-733, -301-764.

Analysis:

The application meets the Approximate Original Contour Restoration requirements as provided in R645-301-731, -732, -733, -764.

ROAD SYSTEMS AND OTHER TRANSPORTATION FACILITIES

Regulatory Reference: 30 CFR Sec. 701.5, 784.24, 817.150, 817.151; R645-100-200, -301-513, -301-521, -301-527, -301-534, -301-537, -301-732.

Analysis:

Reclamation

The application meets the Road Systems and Other Transportation Facilities requirements as provided in R645-301-732. On page VI-38 of the application, the Permittee states "A road not to be retained for use under an approved post-mining land use will be reclaimed immediately after it is no longer needed for coal mining and reclamation operations.

Findings:

The application meets the Road Systems and Other Transportation Facilities requirements as provided in R645-301-732.

CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT

Regulatory Reference: 30 CFR Sec. 784.14; R645-301-730.

Analysis:

The application meets the Cumulative Hydrologic Impact Assessment requirements as provided in R645-301-730. The Permittee has provided sufficient information in order for the Division to prepare an updated Cumulative Hydrologic Impact Assessment (CHIA).

RECOMMENDATIONS:

The application should be approved at this time.

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